

Build Your Own 6 ½ by 15 Attached Hoop Greenhouse

Plans, Techniques, and Instructions

By

w4site



Learning About PVC Pipe

PVC stands for Polyvinyl Chloride. It is a strong, durable plastic noted for its versatility and resistance to chemicals. This makes it an ideal material for plumbing where it is most common. Its low cost and flexibility lead to PVC based designs for a large number of other products as well. w4 is a small engineering firm, which published a wide variety of original PVC pipe designs for items ranging from furniture to carports. Visit our ebay store at <http://www.stores.ebay.com/bluedjinnstreasures>

PVC pipe comes in two grades, normal and UV stabilized. The normal is cheaper, however UV stabilized is recommended for greenhouse designs unless you plan on painting the pipe. The UV stabilized version will not become brittle in the sun as soon. Many home improvement super centers now carry UV stabilized PVC pipe, just ask them. Always use "schedule 40" grade PVC for building greenhouses, as it is tougher and resists wear better.

Some controversy has existed over the environmental harm old PVC pipe may cause, and indeed some have called for restrictions on the amount manufactured in Europe, particularly. A recent report by the European Environmental Agency indicates PVC pipe making actually does more harm than good for the environment. This is because a main ingredient of PVC is chlorine, which is a waste byproduct of Aluminum manufacturing. Using chlorine in PVC makes it a solid again, as in the aluminum ore, thus preventing much chlorine contamination of the atmosphere – said to cause global warming. The EEA concluded this benefit outweighed the waste PVC discarded in landfills. Thus, if you are concerned about the environment, PVC is a good choice for a building material.

The PVC greenhouse described in this booklet is built out of schedule 40 PVC. The PVC pipe greenhouse is made of straight pipe and fittings. The fittings are identified by shape mostly. The fittings used in these plans are TEEs with 3 fitting holes, 90 degree ELLs (shaped like an "L"), 45 degree ELLs (half the angle of the 90s), and CROSSES (sometimes called 4 way connectors).

PVC Pipe Tools

Tools for making PVC pipe greenhouse can range from simple to sophisticated. I've divided them into three levels based on what you want to invest or what you have. The first is Handyman, stuff you must have to do the work. The second is Carpenter and includes stuff that makes the work easier and more professional. The third is Pro, which includes things professionals would use to make the job professional quality and get it done faster. If you don't have a lot of tools, try the first project with the Handyman list, then decide what else you'd prefer to improve your next project. Hammer, nails & screws are required as well.

Handyman Tools List – just the essentials

Tape Measure
Saw
PVC pipe cement
Screwdriver
Craft marking pencil
Gloves

Carpenter Tools List – easier and faster

Tape Measure
Saw with Miter Box
PVC pipe cement
Clear PVC primer
Craft marking pencil
80 grit sand paper
Steel wool
Sheet metal screws, about 1 inch long
Screwdriver
Acetone
Chemical resistant gloves

PRO Tools List – for the pro look

Tape Measure
Chop Saw with 80-tooth finish blade
PVC pipe cement
Clear PVC primer
Craft marking pencil
Finish Sander
Steel wool
Sheet metal screws, about 1 inch long, Phillips
Cordless drill/driver w/ #2 Phillips bits
Acetone
Chemical Resistant Gloves

Preparing PVC Pipe for Connections

PVC pipe is usually stamped with a manufacturer's markings when you buy it from the home improvement store. If you don't plan on painting the pipe in the finished piece, the finished product will look nicer with these markings removed. For best results, remove the markings before cutting or gluing the joints in your project.

To remove the factory marks on PVC, just use a piece of steel wool soaked in acetone to gently rub the markings off. After they dissolve, be sure and wipe the pipe with a clean rag to prevent streaking. Be sure and follow the label on the acetone regarding safe use of this project. Gloves are a good idea. Also, always wear chemical resistant gloves when priming and gluing the PVC joints.

Sometime when gluing joints on the project, excess glue oozes out of the joint and can be unsightly. If this happens to you, it can usually be removed the same way. Also, it's a good idea to wipe the joints as soon as the glue sets as possible for best results. Now the pipe is ready for use in your greenhouse project. Let's get started!

6 ½ x 15 Hoop Lean-To Greenhouse Plan

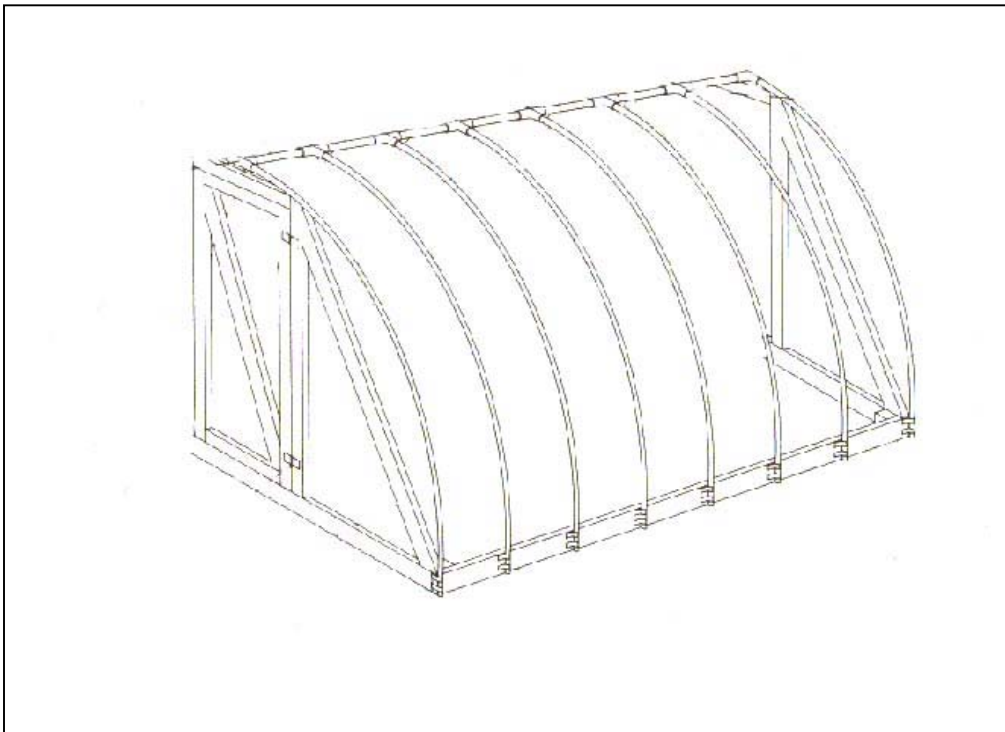
Safety First: When gluing PVC pipe, you should protect your skin and eyes from contact with the cleaner and glue. Purchase a pair of chemical resistant gloves and a set of safety goggles and wear them during all cleaning and gluing operations. It's embarrassing and probably harmful to accidentally glue your fingers together with PVC cement! Be sure and follow the manufacturer's instructions on the cleaners and glue cans. Always work in a well ventilated area – like outside – to insure the fumes are not inhaled. Like any solvent, if you feel light headed, stop and take a break in the fresh air.

This is not full size but a lean to, or attached to the south side eaves of our house. Use an old door on one side. The landscape timbers on the bottom have a 1" hole drilled, 3" deep for the PVC pipe to fit there. The holes were two feet apart. The PVC was inserted into these holes, bent in a semi-circle where a PVC pipe was attached to the other end of the pipe with the 6 TEEs and 2 ELL's that gives you eight PVC pipe ribs to support the structure. The PVC pipe was attached to the eaves with the ¾ inch metal electrical conduit straps over the plastic PVC pipes.



Material List:

- 10, 10 foot, ¾ PVC pipe
- 6, ¾ PVC TEEs
- 2, ¾ PVC ELL's
- 12, ¾ metal electrical conduit straps (or 24 if used on bottom too)
- Eight Landscape timbers, cut to fit 6½ x 15' floor
- 1, 10x25' clear plastic, 6 mil
- 4 1x4x8 for door and end framing
- 2, 1x4x10 for door and end framing
- Assorted nails, screws
- 6" pole barn nails for joining landscape timbers



Overall Assembly Instructions:

Now it's time to build our greenhouse project. The greenhouse consists of a wood ground frame of Landscape timbers with PVC bows attached. The bows hold up the plastic covering and curve over to attach to 3 way TEEs that join at the eave where the greenhouse attaches to the house (see picture below).



Level the foundations boards by digging a trench on the high side rather than raising the low side. Be sure foundation boards contact the ground all around to keep rainwater out. Use 3/8 inch rebar driven through the timbers into the ground at each corner to prevent shifting in the wind.

First obtain the straight pipe and connectors needed from the materials list. Straight pipe usually comes in 10-foot sections, either schedule 40 or 80. Use 80 for this greenhouse for added strength if possible.

The pipe bows are attached to the eaves with electrical tubing clamps. At the ground you can drill holes in the landscape timber for the pipe, or attaché with electrical tubing clamps as well. Attach loosely to the board all along before assembling the boards, and then tighten once tubing is inserted. For a 6 ½ ft wide greenhouse, one 10 ft PVC pipe makes each bow (You can make it wider or taller if you need, by adding another pipe, connectors and joints half way up). The rib connectors should be cut to about 22 ½ inches. Connect ribs and joints with 3 way TEEs connectors as you go. Cut the pieces first. When cutting many pieces of the same length, cut a "master" as exactly as possible, then use the master as a template for the other pieces. This helps the greenhouse come out square. Cut as straight as possible across the pipe, use a miter box or chop saw for best results. Remove any rough spots with sand paper or sander. This will give your greenhouse the professional appearance and strength you would like.

Once the cutting is done, lay out the cut pieces with their connectors to run along the eave as shown in the photo. For best results, “dry fit” without glue first, then check to see how it looks and fits. This is the time to adjust and trim for a professional look. Once all the TEEs are flat, use a pencil to mark a straight line connecting each straight piece to it’s TEE at each end. These lines will help you know “when to stop” while gluing. Now begin gluing together a joint one at a time. Glue each fitting, starting at one end and working along. Be sure and line up your guide marks as you go. The glue sets very rapidly and these lines will help you get the pieces back in the same exact place once glue is applied. As you glue check each joint to be sure your pencil marks line up before the glue sets. PVC glue joints usually set the strongest if you insert the pipe in the fitting, then twist a quarter turn to fully coat the joint. Keep this in mind as you twist the joint to line up your pencil marks. If you make a mistake on a single piece, don’t be afraid to replace it with a new cut straight piece and connector. You’ll be much happier tossing the bad piece now, rather than looking at it daily and reminding yourself how it’s “almost straight or level”.

After all the PVC ribs have been secured the ends a door can be built. Both end frames are the same, one just adds a door. Two wood or PVC diagonals on each end give strength to the structure and make it easy to secure the cover. The top of the end frame may be fastened to the ribs with wood screws (pre drill the PVC pipe to avoid splitting it with the screws). This design can be lengthened or shortened to make a greenhouse of any length by just adding or removing ribs. This allows you to change the size in about 2 foot increments.

Covering Your Greenhouse

There are many ways to cover the greenhouse, ranging from simple construction plastic (cheapest) to special greenhouse plastic or even plastic with air chambers for insulation in colder climates. Sources are listed at the end of the book for various coverings and attachments.

Regular plastic will disintegrate quickly (within 3 months) in our Texas heat. I like to use UV stabilized construction plastic available at most home centers, and attach the plastic with snap clamps you can order at from sources listed later. This allows you to easily change covers as the seasons change (i.e. shade cloth in summer, bird netting at harvest time, plastic in winter). For this method, front and back covers should overlap top/sides cover and be secured with Snap Clamps. Use 1/2-inch self-tapping screws to secure every third Snap Clamp to the frame. Use two screws in 4 ft. Snap Clamps. If you prefer not to spend the money for snap clamps, you can make a similar product by slitting pipe one size larger than the pipe you are using, or even use duct tape (there’s a transparent duct tape now available at Home Depot that works well).

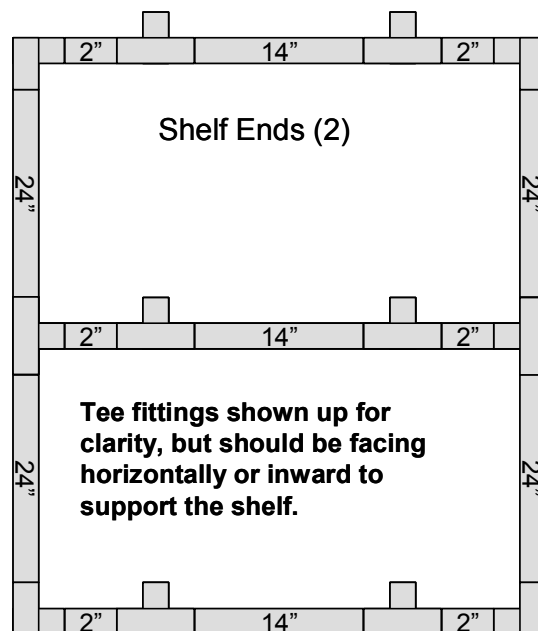
Special greenhouse plastic is also available and warranted to last for 4-6 years. It has a special additive to keep condensation from dripping, by causing moisture to flow down to the sides of the greenhouse, where it won’t affect plants. You can

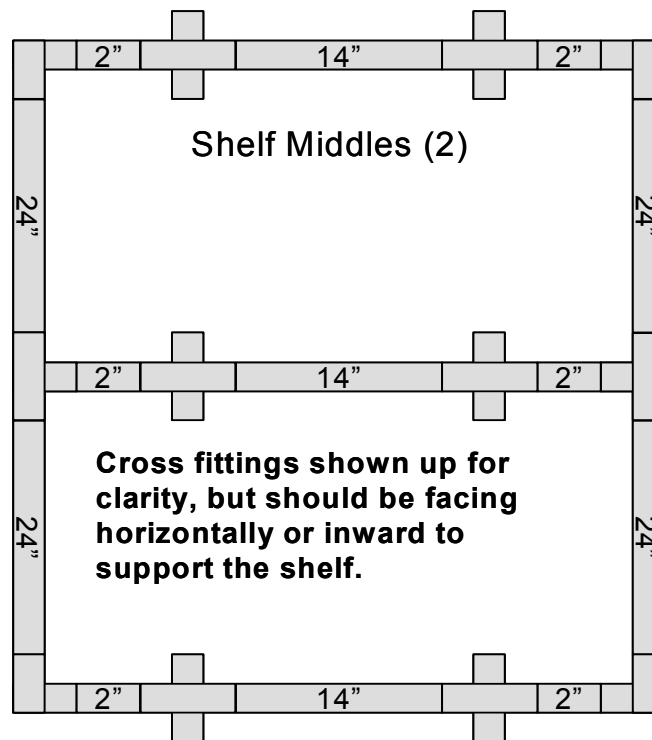
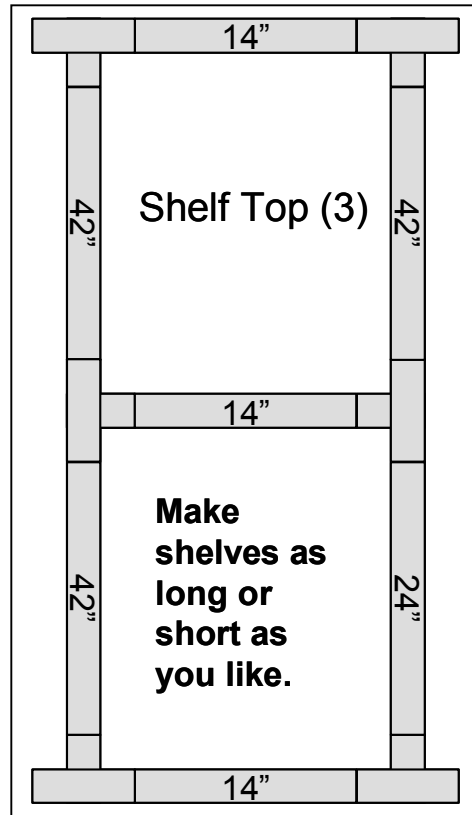
also order their Thermal Film, which claims to allow the highest level of diffused growing light of any thermal film. Plus, it offers high P.A. R. light transmission and contains the condensate control additives also. It can be ordered in whatever sizes you need from sources at the end of this booklet. This is more expensive but requires less maintenance.

The plastic rolls back over the pipe and down to the ground. The plastic is attached to the landscape timbers at the bottom and looped over the top pipe at the eaves.

BONUS - Optional Growing Shelves

To add shelves to your new greenhouse, follow the diagrams. First cut the shelf cross bars as long or short as you need them and assemble the pieces as shown. For the grid on top of the shelves, PVC latticework or wire closet shelves that are plastic coated make the best ones, as they are light weight and resist rusting. Use a material to allow water and light to show through so you can plant less light hungry plants below the shelves to double your growing space. I like to plant spearmint below to discourage pests and create that wonderful smell you expect of a greenhouse!





PVC and Greenhouse Plastic Sources

U.S. Plastics Corporation
1390 Neubrecht Rd.
Lima, OH 45801
www.usplastic.com

Harvel Plastics, Inc.
P.O. Box 757
Easton, PA 18042
www.harvel.com

Engineered Plastics, Inc.
2200 Ponce de Leon Blvd.
St. Augustine, FL 32084
1-800-443-8335
www.engineeredplastics.com

Also try for fittings: www.savko.com
Greenhouse plastic, Northern Greenhouse Sales, 204-327-5540
Greenhouse plastic: <http://www.hobbygardens.com/grenhous.html>

Glossary

PVC – Polyvinyl Chloride is a low cost, high strength plastic

PVC primer – A solvent used to clean PVC connectors and pipe. The “primer” cleans and softens the pipe momentarily to ease assembly. Handle with gloves.

PVC glue – A solvent used to weld PVC pipe and connectors together permanently. Has about a 15-30 second working time, work fast once applied.

TEE connector – Connector to join three pieces of PVC pipe, capital “T” shaped.

ELL connector – Connector to join two pieces of PVC pipe. Capital “L” shaped.

CROSS connector – Connector to join four pieces of PVC pipe, cross-shaped.

End Cap – Used to cover the end of an open pipe. There are two kinds, inside and outside fitting. The inside looks better on greenhouse, where the outside is stronger for water seals.

Greenhouse Plastic – This is a special UV treated and sometimes moisture repellent plastic made especially for greenhouses. Often comes with a warranty.

Construction Plastic – This is a clear or opaque plastic often used for covering greenhouses. Can be with UV resistant coating, recommended for low cost durable covering.

Note: While we believe these plans to be complete, listing all parts and techniques to build the structure, the user should double-check measurements and may need to make adjustments depending on his actual construction site and approach. Plans are sold as is, with no expressed warranty or implied warranty for a particular fitness of purpose. Publisher and author are not responsible for errors or omissions in this document, or any subsequent damages due to construction or use. These plans are carefully checked and have been field tested for your convenience.